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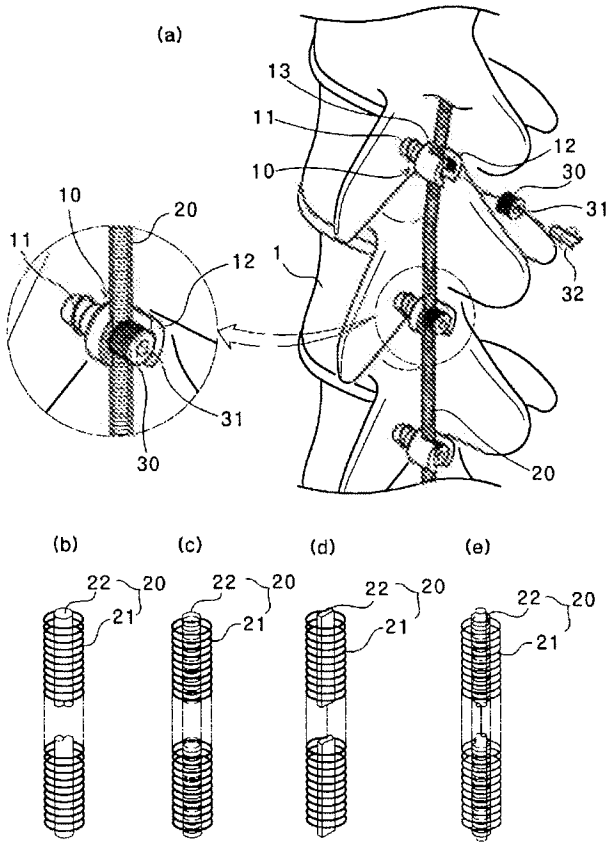
(54) Title: MULTIPLE ROD CONNECTING PEIDCLE SCREWS



(57) Abstract: Disclosed is a multiple connecting rod coupled with pedicle screws in order to support an injured spine of spinal cord injured patients. The multiple connecting rod includes an outer connecting rod rested in coupling grooves formed in head sections of pedicle screws implanted in a spine of a patient, pressed by lower portions of coupling members inserted into the coupling grooves, and fabricated in the form of a coil spring by densely coiling a wire several times, an inner connecting rod accommodated in the outer connecting rod, and a core member accommodated in the inner connecting rod in order to support the inner and outer connecting rods.

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Description

MULTIPLE ROD CONNECTING PEDICLE SCREWS

Technical Field

[1] The present invention relates to a connecting rod for pedicle screws, which is coupled with coupling grooves of the pedicle screws implanted into an injured spine of spinal cord injured patients in order to support the injured spine. More particularly, the present invention relates to a multiple connecting rod for pedicle screws including an inner connecting rod for supporting an injured spine of spinal cord injured patients and an outer connecting rod in the form of a coil spring surrounding the inner connecting rod in order to support the injured spine together with the inner connecting rod.

[2]

Background Art

[3] In general, the spine of a human consists of 34 bones connected to each other through a plurality of spinal joints in such a manner that the human easily bends the body forward or backward.

[4] In addition, discs are provided between adjacent bones in order to dampen external impact applied to the spine.

[5] Nerves extend in left and right directions from between the bones, so the bonds may press nerves if the discs are worn.

[6] Spinal cord injured patients may hardly stand erect so the spinal cord injured patients cannot lead an active life. Even if the spine is partially injured, the spinal cord injured patients may feel pain whenever the injured part of the spine is pressed or makes contact with other parts of the spine.

[7] Therefore, the spinal cord injured patients must undergo a surgical operation in order to support the injured spine by using an artificial aid in such a manner that the injured spine cannot be pressed. The artificial aid used for supporting the injured spine includes pedicle screws implanted into the injured spine in order to fix the injured spine and a connecting rod coupled with the pedicle screws so as to support the injured spine.

[8] FIG. 1 is a view illustrating a conventional connecting rod 19 for pedicle screws, which is disclosed in Korean Patent Application No. 20-2004-00084 filed with Korean Intellectual Property Office on January 3, 2004 by applicant of the present invention. As shown in FIG. 1, the conventional connecting rod 19 is constructed in the form of a spring, so the conventional connecting rod 19 may bend along the contour of the spine of a spinal cord injured patient and return to its initial position as the spinal cord injured patient bends the body forward or backward. Thus, the conventional

connecting rod 19 may facilitate activity of the spinal cord injured patient if the connecting rod 19 is coupled with the spine of the spinal cord injured patient.

[9] Screw sections 11 of pedicle screws 10 are implanted into a spine 1, and the connecting rod 19 is coupled with coupling sections 12 formed at head sections of the pedicle screws 10 in such a manner that the connecting rod 19 can be rested in coupling grooves 13 of the coupling sections 12.

[10] In this state, a fixing bolt 30 is aligned matching with a screw part formed at an inner wall of the coupling section 12, and a coupling tool 32, such as a hexagonal wrench, is inserted into a hexagonal hole 31 formed at an upper portion of the bolt 30 in order to screw-couple the bolt 30 into the coupling section 12.

[11] Accordingly, a lower portion of the fixing bolt 30 presses an outer portion of the connecting rod 19 accommodated in the coupling grooves 13 of the coupling sections 12 so that the connecting rod 19 can be securely rested in the coupling grooves 13 of the coupling sections 12.

[12] In this manner, the connecting rod 19 can be securely installed in the coupling grooves 13 formed in the coupling sections 12 of the pedicle screws 10 while fixedly supporting the spine 1.

[13]

Disclosure of Invention

Technical Problem

[14] However, since the connecting rod 19 is constructed in the form of the spring, the connecting rod 19 may sway whenever the patient moves. Such a sway action of the connecting rod 19 may deform an external appearance of the connecting rod 19, which is semi-permanently installed on the spine 1 of the patient, so that the connecting rod 19 may not match with the contour of the spine 1 of the patient, if the connecting rod 19 has been used for a long period of time. Thus, the connecting rod 19 does not fixedly support the spine 1 of the patient. In addition, since the spring has the residual stress, the patient may feel inconvenienced when the patient bends the body forward due to the residual stress of the spring applied to the spine 1 of the patient. In order to solve the above problem, there has been suggested a method of fabricating a spring having a structure identical to the contour of a spine, but it may present technical problems.

[15]

Technical Solution

[16] Therefore, the present invention has been made in view of the above-mentioned problems, and it is an object of the present invention to provide a dual type connecting rod for pedicle screws, in which the dual type connecting rod includes an outer

connecting rod in the form of a spring easily bent along the contour of the spine of a patient and returned to its initial position as the patient bends the body forward or backward and an inner connecting rod accommodated in the outer connecting rod for supporting the spine together with the outer connecting rod, so that the dual type connecting rod can be prevented from swaying causing deformation of the dual type connecting rod, wherein the inner connecting rod also can be bent along the contour of the spine in such a manner that the dual type connecting rod can stably support the spine of the patient with sufficient strength without causing a side effect and inconvenience of the patient.

[17] Another object of the present invention is to provide a dual type connecting rod for pedicle screws, in which the dual type connecting rod includes an outer connecting rod in the form of a flat coil spring having a rectangular sectional shape and a multi-layered inner connecting rod in the form of a coil spring accommodated in the outer connecting rod and slantingly coiled in such a manner that a coil part thereof crosses with a flat coil part of the outer connecting rod, so that the dual type connecting rod can easily bend along the contour of the spine of a patient and return to its initial position with sufficient strength and elastic force, so the dual type connecting rod can be prevented from swaying without causing inconvenience of the patient.

[18] In order to accomplish the above objects, according to one aspect of the present invention, there is provided a multiple connecting rod comprising: an outer connecting rod rested in coupling grooves formed in head sections of pedicle screws implanted in a spine of a patient and pressed by lower portions of coupling members inserted into the coupling grooves, the outer connecting rod being fabricated in a form of a coil spring by densely coiling a wire several times; and an inner connecting rod accommodated in the outer connecting rod.

[19] The inner connecting rod includes a cylindrical rod being bent along a contour of the spine.

[20] The inner connecting rod includes a coil spring formed by coiling a wire several times.

[21] The inner connecting rod includes the coil spring and a cylindrical rod being bent along a contour of the spine.

[22] The inner connecting rod includes a leaf spring having a rectangular sectional shape and being bent along a contour of the spine.

[23] The inner connecting rod includes a rod section fixed to the pedicle screw and an elastic section connected to the rod section, the rod section and the elastic section being alternately aligned.

[24] The inner connecting rod includes four cylindrical rods having small diameters and being aligned in a rectangular pattern. The four cylindrical rods extend lengthwise

along the outer connecting rod and engage with the outer connecting rod while alternately making contact with inner and outer portions of the outer connecting rod so that the four cylindrical rods are gripped by the outer connecting rod.

[25] The inner connecting rod includes four cylindrical rods having small diameters and being aligned in a rectangular pattern. The four cylindrical rods extend lengthwise along the outer connecting rod in a form of a flat coil spring and engage with the outer connecting rod while alternately making contact with inner and outer portions of the outer connecting rod so that the four cylindrical rods are gripped by the outer connecting rod.

[26] According to another aspect of the present invention, there is provided a multiple connecting rod comprising: an outer connecting rod rested in coupling grooves formed in head sections of pedicle screws implanted in a spine of a patient and pressed by lower portions of coupling members inserted into the coupling grooves, the outer connecting rod being fabricated in a form of a flat coil spring by densely coiling a strip having a rectangular sectional shape several times; an inner connecting rod accommodated in the outer connecting rod and fabricated in a form of a coil spring, which is densely and slantingly coiled such that a coil part thereof crosses with a strip coil part of the outer connecting rod while making contact with an inner surface of the outer connecting rod; and a core member accommodated in the inner connecting rod in order to support the inner and outer connecting rods.

[27] The inner connecting rod is fabricated by using a spring wire and the core member includes a rod.

[28] The inner connecting rod is fabricated in a form of a flat coil spring by slantingly coiling a strip having a rectangular sectional shape and the core member is fabricated in a form of a flat coil spring by slantingly coiling a strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod crosses with a flat coil part of the core member.

[29] The inner connecting rod is fabricated in a form of a flat coil spring by coiling a strip having a rectangular sectional shape, and the core member includes a rod.

[30] The outer connecting rod has a gap formed between strip parts thereof.

[31] The multiple connecting rod has a curved structure corresponding to a contour of the spine.

[32] The inner connecting rod has a multi-layered structure, in which a flat coil part densely and slantingly formed in one layer of the inner connecting rod crosses with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[33] The multiple connecting rod has a curved structure corresponding to a contour of the spine.

[34] The outer connecting rod, the inner connecting rod and the core member are made

from stainless materials or titanium materials used for medical treatment.

[35] According to the multiple connecting rod for pedicle screws of the present invention, the outer connecting rod in the form of the spring may bend along the contour of the spine of the patient and return to its initial position when the patient bends the body forward or backward, thereby facilitating the medical treatment for the patient while improving convenience of the patient. In addition, the inner connecting rod accommodated in the outer connecting rod supports the spine together with the outer connecting rod, thereby preventing the dual type connecting rod from swaying causing the deformation of the dual type connecting rod. The inner connecting rod also can be bent along the contour of the spine so that the dual type connecting rod can stably support the spine of the patient without causing a side effect and inconvenience of the patient.

[36] In addition, according to another embodiment of the present invention, the multiple connecting rod for pedicle screws includes an outer connecting rod in the form of a flat coil spring and an inner connecting rod accommodated in the outer connecting rod with predetermined elasticity. Thus, the dual type connecting rod may bend along the contour of the patient and return to its initial position as the patient bends the body forward or backward, thereby facilitating the medical treatment for the patient while improving convenience of the patient. In addition, a coil part of the inner connecting rod supporting the spine together with the outer connecting rod is densely and slantingly coiled while crossing with coil parts of the outer connecting rod and a core member. Therefore, strength of the dual type connecting rod can be enhanced and the dual type connecting rod can be prevented from swaying, thereby improving convenience of the patient without causing the side effect.

[37]

Brief Description of the Drawings

[38] The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

[39] FIG. 1 is a perspective view illustrating an installation state of a conventional connecting rod having predetermined elasticity for pedicle screws;

[40] FIG. 2 (a) is a perspective view illustrating a dual type connecting rod having predetermined elasticity coupled with pedicle screws according to one embodiment of the present invention;

[41] FIG. 2 (b) is a perspective view illustrating an inner connecting rod having a cylindrical structure according to one embodiment of the present invention;

[42] FIG. 2 (c) is a perspective view illustrating an inner connecting rod in the form of a

coil spring according to another embodiment of the present invention;

[43] FIG. 2 (d) is a perspective view illustrating an inner connecting rod in the form of a leaf spring according to still another embodiment of the present invention;

[44] FIG. 2 (e) is a perspective view illustrating an inner connecting rod in the form of a coil spring having a cylindrical rod therein according to still yet embodiment of the present invention;

[45] FIG. 3 (a) is a perspective view illustrating an inner connecting rod including spring sections and rod sections, which are alternately aligned according to one embodiment of the present invention;

[46] FIG. 3 (b) is a perspective view illustrating four inner connecting rods accommodated in an outer connecting rod according to one embodiment of the present invention;

[47] FIG. 3 (c) is a perspective view illustrating four inner connecting rods accommodated in an outer connecting rod in the form of a flat coil spring according to one embodiment of the present invention;

[48] FIG. 4 is a perspective view illustrating a multiple connecting rod coupled with pedicle screws according to one embodiment of the present invention; and

[49] FIGS. 5 (a) ~ (g) are plan views illustrating multiple connecting rods for pedicle screws according to another embodiments of the present invention.

[50]

Best Mode for Carrying Out the Invention

[51] Reference will now be made in detail to the preferred embodiments of the present invention. A dual type connecting rod according to one embodiment of the present invention includes an outer connecting rod and an inner connecting rod accommodated in the outer connecting rod, in which the outer connecting rod is in the form of a coil spring.

[52] FIG. 2 (a) is a perspective view illustrating the dual type connecting rod having predetermined elasticity coupled with pedicle screws according to one embodiment of the present invention.

[53] The dual type connecting rod 20 according to the present invention is rested in coupling sections 12 of pedicle screws 10 and fixedly coupled with the pedicle screws 10 implanted into a spine 1 by means of coupling members.

[54] As shown in FIG. 2 (a), each pedicle screw 10 includes a screw section 11 implanted into the spine 1 and a coupling section 12 having a coupling groove 13 formed at an upper portion of the screw section 11 in order to receive the dual type connecting rod 20 therein. The coupling groove 13 is formed at an inner wall thereof with a thread section. A fixing bolt 30 formed with an insertion hole 31 having a pre-

determined depth is screw-coupled into the coupling groove 13 of the pedicle screw 10. A coupling tool 32, such as a hexagonal wrench, is inserted into the insertion hole 31 of the fixing bolt 30 in order to rotate the fixing bolt 30.

[55] The dual type connecting rod 20 includes an outer connecting rod 21, which is pressed by a lower portion of the fixing bolt 30, and an inner connecting rod 22 accommodated in the outer rod 21 and made from titanium or stainless material.

[56] The outer connecting rod 21 is fabricated in the form of a coil spring by coiling a wire made from titanium or stainless material several times. At this time, the coil spring is densely formed in such a manner that a pitch of the coil spring is smaller than a diameter of the fixing bolt 30. In addition, a diameter of the coil spring forms an outer diameter of the dual type connecting rod 20. The outer diameter of the dual type connecting rod 20 is identical to or smaller than a width of the coupling groove 13 of the coupling section 12 so that the dual type connecting rod 20 can be securely accommodated in the coupling groove 13 of the coupling section 12.

[57] As shown in FIG. 2 (b), the inner connecting rod 22 is fabricated in the form of a cylindrical rod having a predetermined elastic property. In this case, the inner connecting rod 22 has a diameter smaller than that of the outer connecting rod 21 and can be bent along the contour of the spine of the patient.

[58] The inner connecting rod 22 is accommodated in the outer connecting rod 21 lengthwise along the outer connecting rod 21. Thus, although elastic force of the dual type connecting rod 20 applied to the spine of the dual type connecting rod 20 is slightly lower than that of the conventional connecting rod 19 shown in FIG. 1, shearing force applied vertically to an outer peripheral portion of the outer connecting rod 21 is transferred to an outer peripheral portion of the inner connecting rod 22 so that the inner connecting rod 22 may act as a support, thereby preventing the outer connecting rod 21 from swaying. Thus, the outer connecting rod 21 can be prevented from being deformed. In addition, the inner connecting rod 22 can be bent along the contour of the spine of the patient as the patient bends the body forward or backward, thereby effectively supporting the spine of the patient without causing inconvenience of the patient.

[59] That is, since the dual type connecting rod 20 according to the present invention can support the spine of the patient while maintaining elastic force thereof in a level corresponding to 70 to 80% of elastic force of the conventional connecting rod 19, the outer connecting rod (coil spring) 21 can be prevented from swaying. Thus, the outer connecting rod 21 can be prevented from being deformed even if the dual type connecting rod 20 is used for a long period of time.

[60] In addition, according to another embodiment of the present invention as shown in FIG. 2 (c), the inner connecting rod 22 can be fabricated in the form of a coil spring

having a predetermined diameter by coiling a wire several times. At this time, the coil spring is densely formed in such a manner that a pitch of the coil spring is smaller than a diameter of the fixing bolt 30.

[61] In addition, according to still another embodiment of the present invention as shown in FIG. 2 (d), the inner connecting rod 22 can be fabricated in the form of a leaf spring having a rectangular sectional structure and capable of bending along the contour of the spine of the patient. At this time, a width of the inner connecting rod 22 is smaller than an inner diameter of the outer connecting rod 21.

[62] In addition, according to still yet another embodiment of the present invention as shown in FIG. 2 (e), the inner connecting rod 22 can be fabricated in the form of a coil spring having a cylindrical rod therein. At this time, the cylindrical rod has pre-determined elastic force with a diameter smaller than that of the coil spring and can be bent along the contour of the spine of the patient.

[63] FIGS. 3 (a) ~ (c) are perspective views illustrating modified inner connecting rods accommodated in the outer connecting rod in the form of a coil spring.

[64] As shown in FIG. 3 (a), the inner connecting rod 22 may include cylindrical rod sections 23 and spring sections 24, which are alternately aligned. The cylindrical rod section 23 supports the outer connecting rod 21 when the dual type connecting rod 20 is coupled with the pedicle screws and the spring section 24 applies elastic force to the spine of the patient.

[65] As shown in FIG. 3 (b), the inner connecting rod 22 may include four cylindrical rods having small diameters and being aligned in a rectangular pattern. In this case, the four cylindrical rods extend lengthwise along the outer connecting rod 21 while engaging with the outer connecting rod 21. That is, the four cylindrical rods extend lengthwise while alternately making contact with inner and outer portions of the outer connecting rod 21 so that the four cylindrical rods are gripped by the outer connecting rod 22.

[66] In addition, as shown in FIG. 3 (c), the dual type connecting rod 20 according to the present invention may include the outer connecting rod 21 in the form of a flat coil spring and the inner connecting rod 22 having four cylindrical rods aligned in a rectangular pattern with small diameters. In this case, the four cylindrical rods extend lengthwise along the flat coil spring while engaging with the flat coil spring. That is, the four cylindrical rods extend lengthwise while alternately making contact with inner and outer portions of the flat coil spring so that the four cylindrical rods are gripped by the flat coil spring.

[67] The dual type connecting rod shown in FIGS. 2 (c) ~ (e) has a function and an effect substantially identical to those of the dual type connecting rod shown in FIGS. 3 (a) ~ (c).

[68] After the dual type connecting rod 20 has been rested in the coupling grooves 13 of the coupling sections 12 of the pedicle screws, fixing bolts 30 are screw-coupled into the coupling grooves 13. At this time, since the fixing bolts have diameters smaller than the pitch of the coil spring, the fixing bolts 30 press the outer peripheral portion of the outer connecting rod 21 so that the dual type connecting rod 20 can be fixedly coupled with the pedicle screws.

[69] As described above, the dual type connecting rod 20 coupled with the pedicle screws 10 has the outer connecting rod in the form of the coil spring, the dual type connecting rod 20 can bend along the contour of the spine of the patient as the patient bends the body forward or backward, thereby ensuring flexibility of the spine of the patient. In addition, the inner connecting rod 22 is accommodated in the outer connecting rod 21 so as to support the spine of the patient together with the outer connecting rod 21 so that the outer connecting rod is prevented from swaying. Thus, the outer connecting rod can be prevented from being deformed, thereby improving convenience of the patient.

[70] Although it has been described that the outer connecting rod 21 and the inner connecting rod 22 of the dual type connecting rod 20 are made from titanium or stainless material, the present invention does not limit materials for the outer connecting rod 21 and the inner connecting rod 22. Various materials can be used for the outer connecting rod 21 and the inner connecting rod 22 if they have a pre-determined elastic property and are adaptable for medical treatment.

[71] Hereinafter, a structure and an operation of a multiple connecting rod according to one embodiment of the present invention will be described in detail. According to the present invention, the multiple connecting rod includes an outer connecting rod, an inner connecting rod accommodated in the outer connecting rod, and a core member accommodated in the inner connecting rod, in which the outer connecting rod is constructed in the form of a flat coil spring.

[72] FIG. 4 is a perspective view illustrating the multiple connecting rod 20 coupled with pedicle screws 10 according to one embodiment of the present invention.

[73] The multiple connecting rod 20 according to one embodiment of the present invention is rested in coupling sections 12 of the pedicle screws 10 and fixedly coupled with the pedicle screws 10 implanted into a spine 1 by means of coupling members.

[74] As shown in FIG. 4, each pedicle screw 10 includes a screw section 11 implanted into the spine 1 and a coupling section 12 having a coupling groove 13 formed at an upper portion of the screw section 11 in order to receive the multiple connecting rod 20 therein. The coupling groove 13 is formed at an inner wall thereof with a thread section. A fixing bolt 30 formed with an insertion hole 31 having a predetermined depth is screw-coupled into the coupling groove 13 of the pedicle screw 10. A

coupling tool 32, such as a hexagonal wrench, is inserted into the insertion hole 31 of the fixing bolt 30 in order to rotate the fixing bolt 30.

[75] The multiple connecting rod 20 includes an outer connecting rod 21 which is pressed by the fixing bolt 30, an inner connecting rod 22 accommodated in the outer connecting rod 21, and a core member 25 accommodated in the inner connecting rod 22.

[76] As shown in FIG. 5 (a), the outer connecting rod 21 is fabricated in the form of a flat coil spring by coiling a thin strip having a rectangular sectional shape several times. At this time, the flat coil spring is densely formed in such a manner that the flat coil spring does not form a gap between strip parts.

[77] An outer diameter of the outer connecting rod 21 is smaller than a diameter of the fixing bolt 30. In addition, the outer diameter of the outer connecting rod 22 is identical to or smaller than a width of the coupling groove 13 of the coupling section 12 so that the multiple connecting rod 20 can be securely accommodated in the coupling groove 13 of the coupling section 12.

[78] The inner connecting rod 22 is fabricated in the form of a coil spring, which is densely and slantingly coiled such that a coil part thereof crosses with a strip coil part of the outer connecting rod 21 while making contact with an inner surface of the outer connecting rod 21. In this case, strength of the multiple connecting rod 20 can be improved without degrading elastic force thereof.

[79] In addition, the inner connecting rod 22 is formed by densely coiling a spring wire having a small diameter several times such that the inner connecting rod 22 makes contact with the inner surface of the outer connecting rod 21. At this time, the spring wire is slantingly coiled in such a manner that the spring wire may cross with the strip coil part of the outer connecting rod 21.

[80] The core member 25 having a small diameter is accommodated in the inner connecting rod 22. The core member 25 makes contact with an inner surface of the inner connecting rod 22 and acts as a central support for the multiple connecting rod 20.

[81] FIG. 5 (b) shows a multiple connecting rod according to another embodiment of the present invention. Differently from the outer connecting rod shown in FIG. 5 (a), the outer connecting rod 21 shown in FIG. 5 (b) is fabricated in the form of a flat coil spring having a predetermined pitch in a range of about 1 to 2mm by coiling a thin strip several times.

[82] If the flat coil spring is densely formed without forming the predetermined pitch, adjacent strips of the multiple connecting rod 20 may interfere with each other when the multiple connecting rod 20 bends along the contour of the spine. Thus, it is preferred to form the predetermined pitch in the flat coil spring.

[83] As described above with reference to FIG. 5 (a), the inner connecting rod 22 in the form of the coil spring, which is densely and slantingly coiled such that a coil part thereof crosses with a strip coil part of the outer connecting rod 21, is accommodated in the outer connecting rod 21. In addition, the core member 25 having a small diameter is accommodated in the inner connecting rod 21.

[84] FIG. 5 (c) shows a multiple connecting rod according to still another embodiment of the present invention. As shown in FIG. 5 (c), the outer connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times without forming a gap between strip parts.

[85] The inner connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod 22 crosses with a flat coil part of the outer connecting rod 21. In addition, the core member 25 accommodated in the inner connecting rod 22 is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the core member 25 crosses with the flat coil part of the inner connecting rod 22.

[86] Although the inner connecting rod 22 having a single-layered structure is shown in FIG. 5 (c), if the outer diameter of the multiple connecting rod 20 is determined, it is possible to form the inner connecting rod 22 in a multi-layered structure within a range of the outer diameter of the multiple connecting rod 20. In this case, a flat coil part densely and slantingly formed in one layer of the inner connecting rod 22 may cross with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[87] FIG. 5 (d) shows a multiple connecting rod according to still another embodiment of the present invention. As shown in FIG. 5 (d), the outer connecting rod 21 is fabricated in the form of a flat coil spring having a predetermined pitch in a range of about 1 to 2mm by coiling a thin strip several times.

[88] The inner connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod 22 crosses with a flat coil part of the outer connecting rod 21. In addition, the core member 25 accommodated in the inner connecting rod 22 is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the core member 25 crosses with the flat coil part of the inner connecting rod 22.

[89] If the outer diameter of the multiple connecting rod 20 is determined, it is possible to form the inner connecting rod 22 in a multi-layered structure within a range of the

outer diameter of the multiple connecting rod 20. In this case, a flat coil part densely and slantingly formed in one layer of the inner connecting rod 22 may cross with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[90] FIG. 5 (e) shows a multiple connecting rod according to still another embodiment of the present invention. As shown in FIG. 5 (e), the outer connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times without forming a gap between strip parts.

[91] The inner connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod 22 crosses with a flat coil part of the outer connecting rod 21. In addition, the core member 25 in the form of a rod having a small diameter is installed in the inner connecting rod 22.

[92] If the outer diameter of the multiple connecting rod 20 is determined, it is possible to form the inner connecting rod 22 in a multi-layered structure within a range of the outer diameter of the multiple connecting rod 20. In this case, a flat coil part densely and slantingly formed in one layer of the inner connecting rod 22 may cross with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[93] FIG. 5 (f) shows a multiple connecting rod according to still another embodiment of the present invention. As shown in FIG. 5 (f), the outer connecting rod 21 is fabricated in the form of a flat coil spring having a predetermined pitch in a range of about 1 to 2mm by coiling a thin strip several times.

[94] The inner connecting rod 22 is fabricated in the form of a flat coil spring, which is formed by densely and slantingly coiling a thin strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod 22 crosses with a flat coil part of the outer connecting rod 21. In addition, the core member 25 in the form of a rod having a small diameter is installed in the inner connecting rod 22.

[95] If the outer diameter of the multiple connecting rod 20 is determined, it is possible to form the inner connecting rod 22 in a multi-layered structure within a range of the outer diameter of the multiple connecting rod 20. In this case, a flat coil part densely and slantingly formed in one layer of the inner connecting rod 22 may cross with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[96] Preferably, as shown in FIG. 5 (g), the multiple connecting rod 20 is fabricated in a curved structure corresponding to the contour of the spine of the patient, such that the multiple connecting rod 20 does not cause inconvenience of the patient. In addition, the outer connecting rod 21, the inner connecting rod 22 and the core member 25 can

be fabricated by using various materials, such as stainless materials and titanium materials, if they have a predetermined elastic property and are adaptable for medical treatment.

[97] As mentioned above, the connecting rod 20 fixedly coupled with the pedicle screws 10 includes the outer connecting rod 21 in the form of the spring so that the outer connecting rod can be bent along the contour of the spine of the patient as the patient bends the body forward or backward, thereby ensuring flexibility of the spine of the patient. In addition, the inner connecting rod 22 is accommodated in the outer connecting rod 21 and the core member 25 is accommodated in the inner connecting rod 22 so as to support the spine of the patient together with the outer connecting rod 21. Thus, the outer connecting rod 21 can be prevented from swaying.

[98]

Industrial Applicability

[99] As can be seen from the foregoing, the connecting rod according to the present invention is coupled with the coupling grooves formed in the pedicle screws implanted into the injured spine of the patient, thereby supporting the inured spine.

[100] While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment and the drawings, but, on the contrary, it is intended to cover various modifications and variations within the spirit and scope of the appended claims.

[101]

Claims

[1] A multiple connecting rod comprising:
an outer connecting rod rested in coupling grooves formed in head sections of pedicle screws implanted in a spine of a patient and pressed by lower portions of coupling members inserted into the coupling grooves, the outer connecting rod being fabricated in a form of a coil spring by densely coiling a wire several times; and
an inner connecting rod accommodated in the outer connecting rod.

[2] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes a cylindrical rod being bent along a contour of the spine.

[3] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes a coil spring formed by coiling a wire several times.

[4] The multiple connecting rod as claimed in claim 3, wherein the inner connecting rod includes the coil spring and a cylindrical rod being bent along a contour of the spine.

[5] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes a leaf spring having a rectangular sectional shape and being bent along a contour of the spine.

[6] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes a rod section fixed to the pedicle screw and an elastic section connected to the rod section, the rod section and the elastic section being alternately aligned.

[7] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes four cylindrical rods having small diameters and being aligned in a rectangular pattern, the four cylindrical rods extending lengthwise along the outer connecting rod and engaging with the outer connecting rod while alternately making contact with inner and outer portions of the outer connecting rod so that the four cylindrical rods are gripped by the outer connecting rod.

[8] The multiple connecting rod as claimed in claim 1, wherein the inner connecting rod includes four cylindrical rods having small diameters and being aligned in a rectangular pattern, the four cylindrical rods extending lengthwise along the outer connecting rod in a form of a flat coil spring and engaging with the outer connecting rod while alternately making contact with inner and outer portions of the outer connecting rod so that the four cylindrical rods are gripped by the outer connecting rod.

[9] A multiple connecting rod comprising:
an outer connecting rod rested in coupling grooves formed in head sections of

pedicle screws implanted in a spine of a patient and pressed by lower portions of coupling members inserted into the coupling grooves, the outer connecting rod being fabricated in a form of a flat coil spring by densely coiling a strip having a rectangular sectional shape several times;

an inner connecting rod accommodated in the outer connecting rod and fabricated in a form of a coil spring, which is densely and slantingly coiled such that a coil part thereof crosses with a strip coil part of the outer connecting rod while making contact with an inner surface of the outer connecting rod; and

a core member accommodated in the inner connecting rod in order to support the inner and outer connecting rods.

[10] The multiple connecting rod as claimed in claim 9, wherein the inner connecting rod is fabricated by using a spring wire and the core member includes a rod.

[11] The multiple connecting rod as claimed in claim 9, wherein the inner connecting rod is fabricated in a form of a flat coil spring by slantingly coiling a strip having a rectangular sectional shape and the core member is fabricated in a form of a flat coil spring by slantingly coiling a strip having a rectangular sectional shape several times in such a manner that a flat coil part of the inner connecting rod crosses with a flat coil part of the core member.

[12] The multiple connecting rod as claimed in claim 9, wherein the inner connecting rod is fabricated in a form of a flat coil spring by coiling a strip having a rectangular sectional shape, and the core member includes a rod.

[13] The multiple connecting rod as claimed in any one of claims 10 to 12, wherein the outer connecting rod has a gap formed between strip parts thereof.

[14] The multiple connecting rod as claimed in claim 13, wherein the multiple connecting rod has a curved structure corresponding to a contour of the spine.

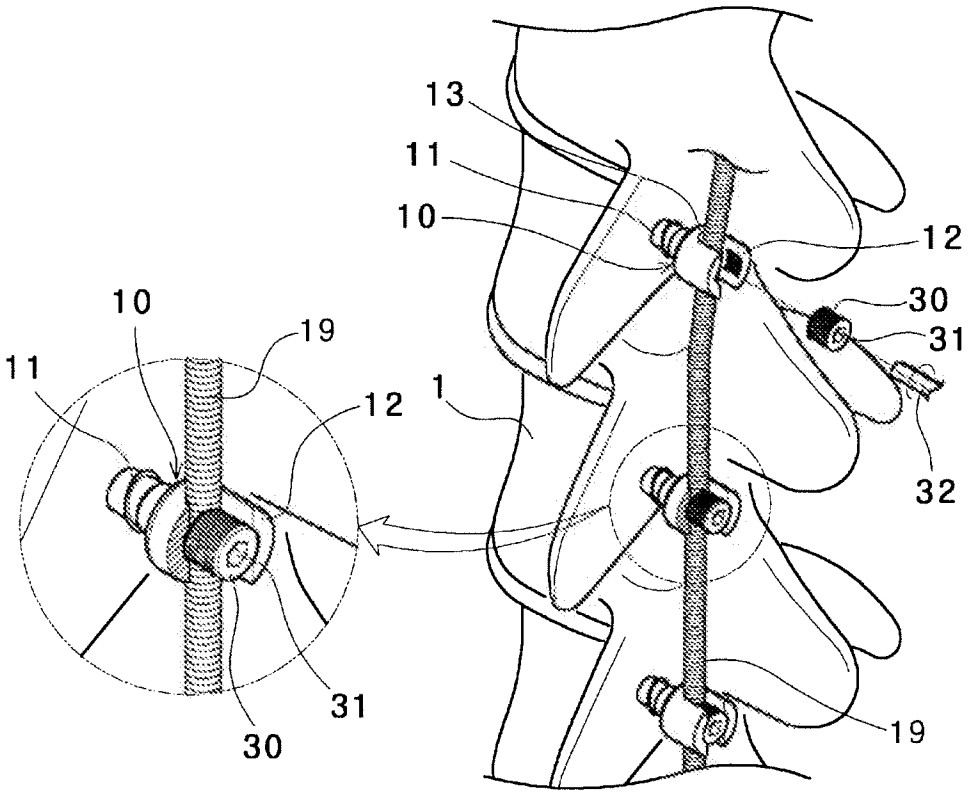
[15] The multiple connecting rod as claimed in claim 11 or 12, wherein the inner connecting rod has a multi-layered structure, in which a flat coil part densely and slantingly formed in one layer of the inner connecting rod crosses with a flat coil part densely and slantingly formed in an adjacent layer thereof.

[16] The multiple connecting rod as claimed in claim 15, wherein the multiple connecting rod has a curved structure corresponding to a contour of the spine.

[17] The multiple connecting rod as claimed in claim 9, wherein the outer connecting rod, the inner connecting rod and the core member are made from stainless materials or titanium materials used for medical treatment.

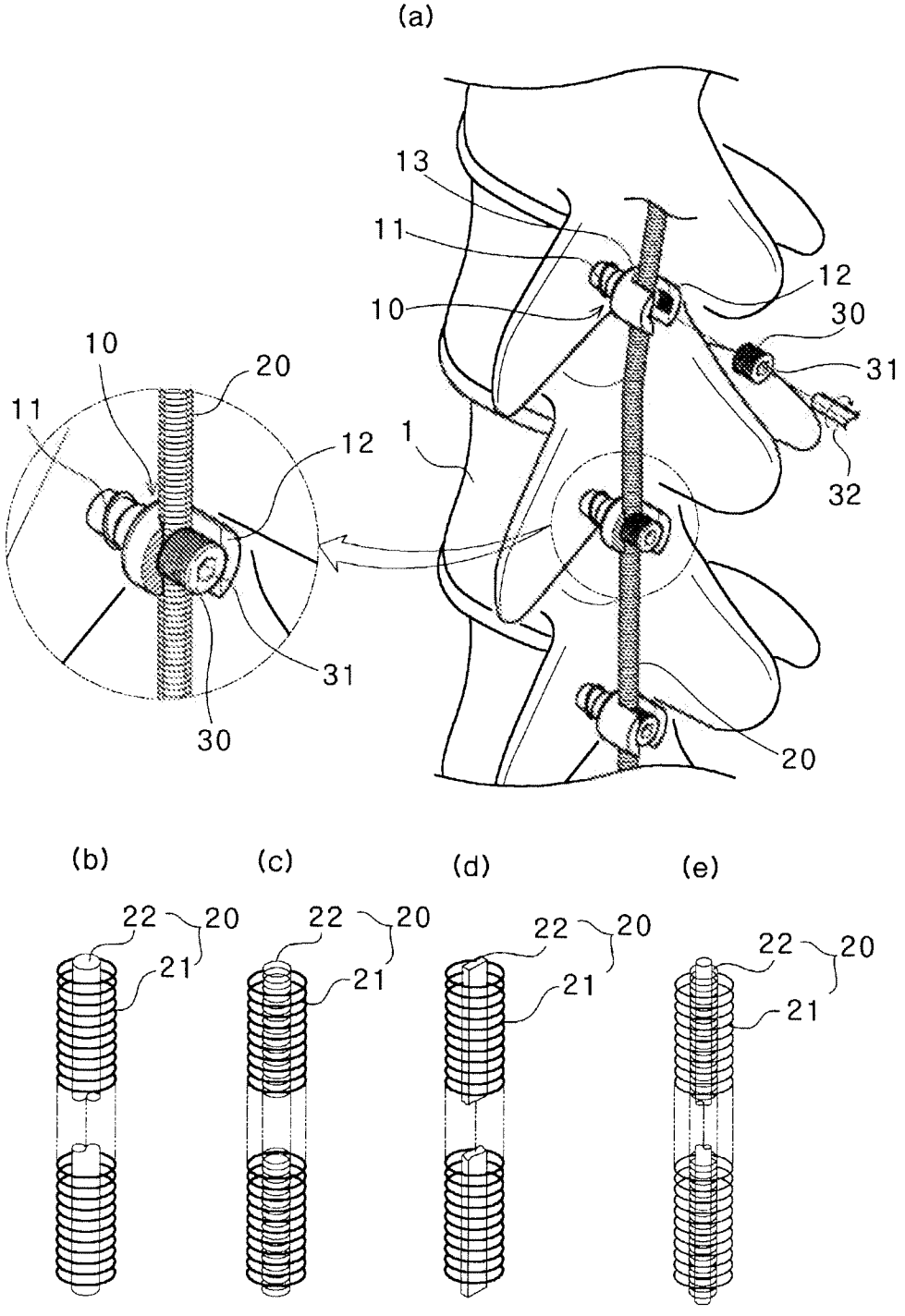
WO 2005/092222 PCT/KR2005/000651

[Fig. 1]

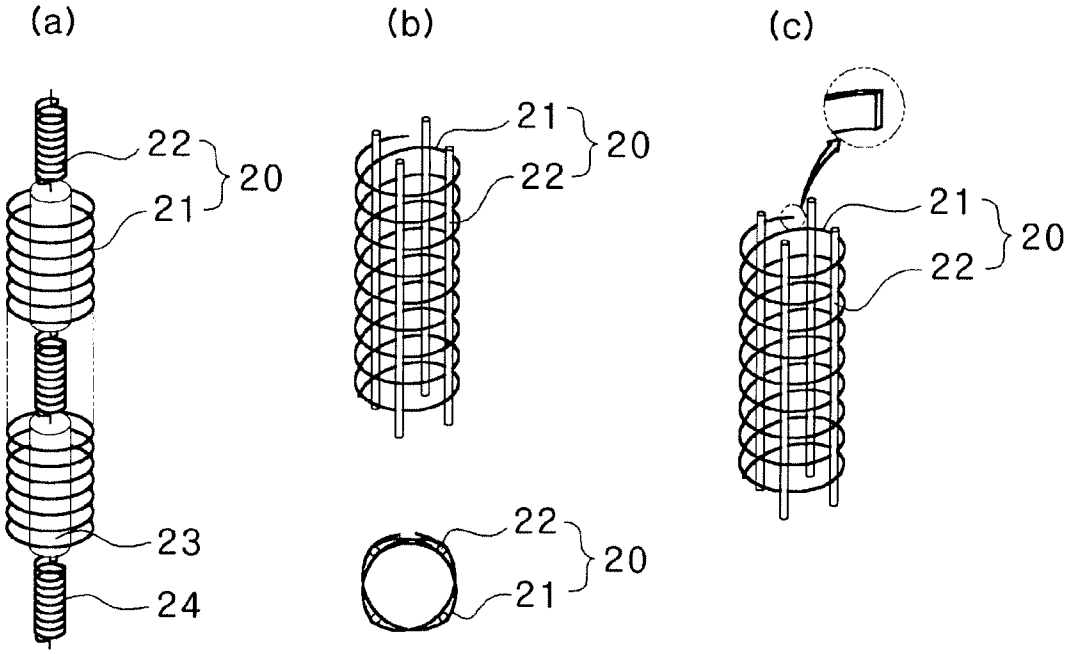


WO 2005/092222 PCT/KR2005/000651

[Fig. 2]



[Fig. 3]


(a)
(b)
(c)
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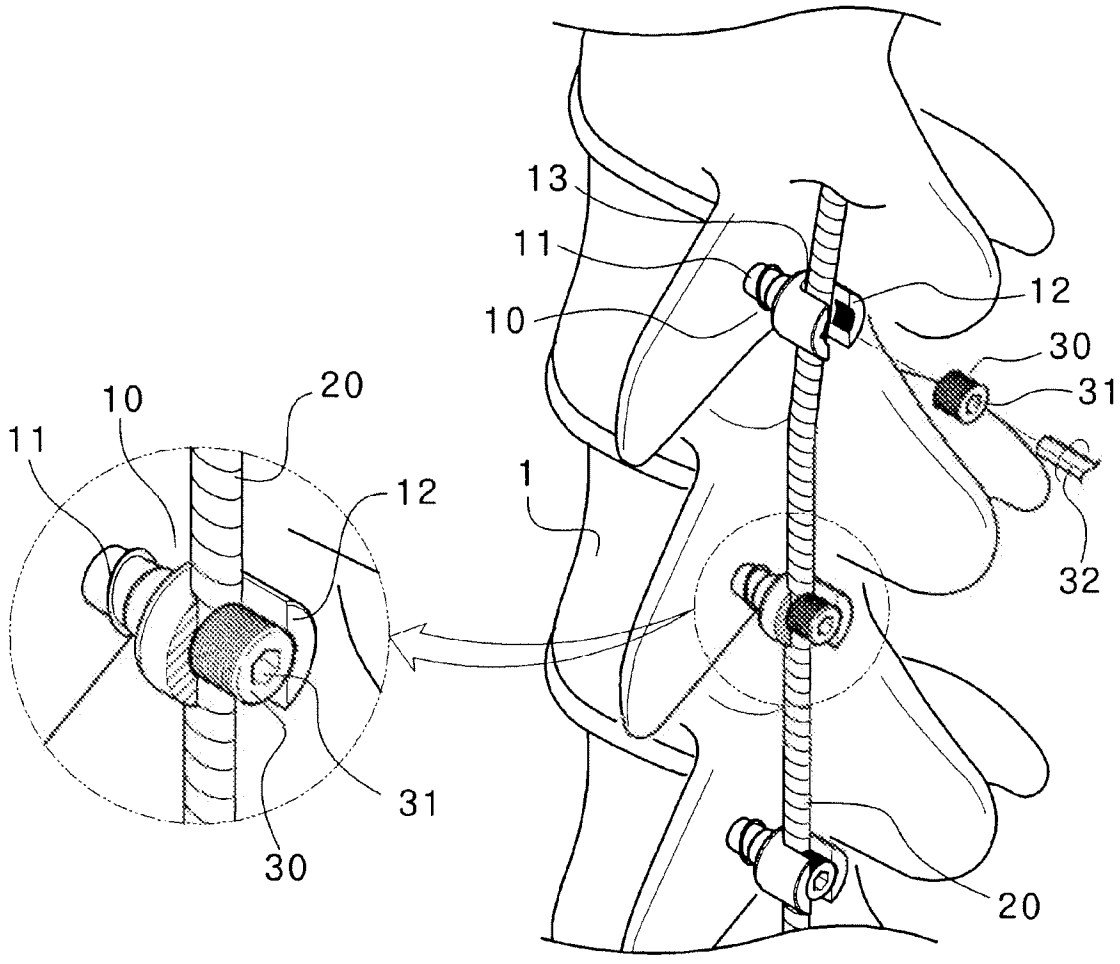
[Fig. 4]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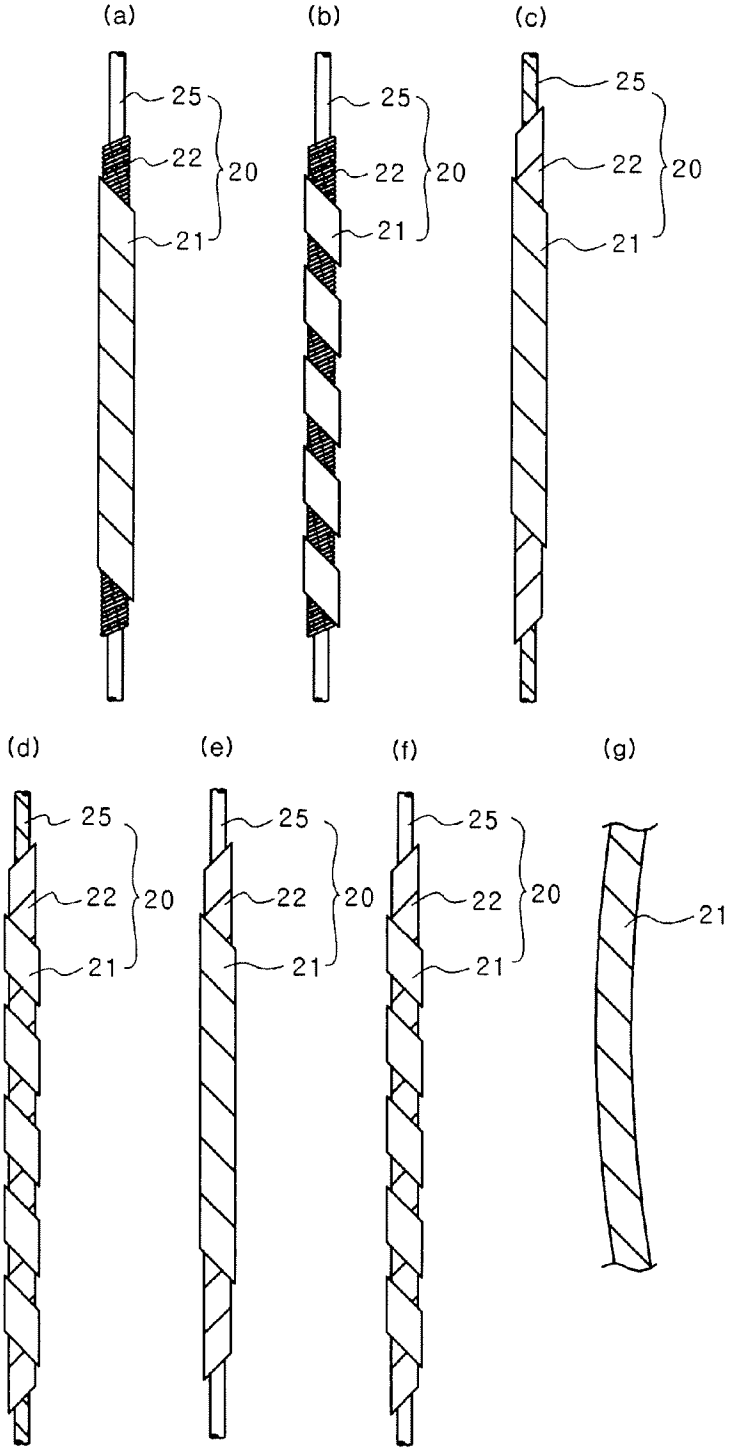
[Fig. 5]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/000651

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A61B 17/70

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 A61B 17/70

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applictions for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS, Delphion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- A	EP 669109 A1 (SULZER MEDIZINALTECHNIK AG) 30 August 1995 See the whole document.	1-3,5 --- 4,6-17
X -- A	US 5733284 A (Paulette Fairant) 31 March 1998 See the whole document.	1-3,5 --- 4,6-17
X -- A	EP 1388323 A1 (BIEDERMANN MOTECH GMBH) 11 February 2004 See the whole document.	1-3,5 --- 4,6-17
X -- A	US 5423816 A (Chih I. Lin) 13 June 1995 See the whole document.	1,6 --- 2-5,7-17

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 JULY 2005 (11.07.2005)	**12 JULY 2005 (12.07.2005)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer LEE, CHUNG HO Telephone No. 82-42-481-8160

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/000651

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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